

RESEARCH DEPARTMENT

**TRANSISTORIZED E.H.T. SUPPLY FOR MULTIPLIER PHOTO-CELLS**

Technological Report No. T-129

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H.A.S. Philippart, A.M.I.E.R.E.

*D. Maurice*

(D. Maurice)

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### 1. INTRODUCTION

Multiplier photo-cells normally require a high-tension supply of the order of 1000 volts. This supply is usually obtained from the electricity supply mains by means of conventional rectifiers and stabilizing circuits. Mains surges can still be detected, however, unless more complex and bulky equipment is used. In the case of a fixed installation this is not of great importance, but when portability and good short-term stability are required, different equipment is necessary. Batteries, accumulators or Mallory cells are ideal with regard to short-term stability, but, of course, the number required to obtain high voltages is excessive, and there is also considerable danger to personnel. In order to overcome these difficulties, a transistorized d.c. to d.c. converter has been designed and constructed.

### 2. SPECIFICATION

For use with the EMI 5924/28 type multiplier photo-cells, the specification is as follows:

Output voltage: from 800 V to 1300 V,  
controllable from front panel.

Output current: 500  $\mu$ A to 800  $\mu$ A

Normal current variations:  $\pm 50\mu$ A

Supply voltage: 6.3 V accumulator or Mallory Cells.

For general laboratory work, where a somewhat higher output current is sometimes required, the unit should be capable of giving 1.5 mA. This latter requirement is typical of the RCA type 6217 photo-cell.

### 3. DESCRIPTION

The complete converter unit, whose circuit is shown in Fig. 1, consists of the usual push-pull relaxation oscillator, operating at a frequency in the region of

1000 c/s, followed by a Cockcroft-Walton voltage quadrupler. Fig. 2 shows a photograph of the complete unit.

In order to vary the output voltage it is clearly undesirable to add circuits to the output of the voltage quadrupler. Therefore, to retain simplicity, a series voltage regulator is inserted between the supply and the converter input, the reference voltage being obtained by two 1.5 V nickel-cadmium voltage-stabilizing cells in series. These stabilizers are used instead of the more usual Zener diodes, as 3 V Zener diodes are not available. The output may be varied over the required range by varying the comparison feed-back voltage.

An extra stabilizer cell is available to increase the reference voltage to 4.5 V, should it be required to change the range of variation, or should different input or output voltages be specified.

#### 4. PERFORMANCE

The following figures show the performance of the unit and are self-explanatory.

Fig. 3. Output voltage as a function of input voltage of the voltage regulator, at one setting of its range.

Fig. 4. Output voltage as a function of output current of converter only.

Fig. 5. Output voltage as a function of output current of complete unit.

Additional performance figures are as follows:

Output Ripple: 0.5 %

Efficiency - between 50% and 80% depending on requirements

Dimensions 5½ in x 5¼ in x 8 in

Weight 3½ lbs.

#### 5. REFERENCES

1. Handbook of Semi-Conductor Electronics, McGraw Hill, 1956.
2. 'D.C. to D.C. Transistorized Converters', Holme, R.A., Standard Telephone and Cables Ltd., 1960.
3. CHASE, F.H., HAMILTON, B.H. and SMITH, D.H.: 'Transistors and Junction Diode in Telephone Power Plant', The Bell System Technical Journal, July 1954.
4. 'Silicon Voltage Regulator Zener Diodes', Texas Instrument Ltd., Application report, Vol. 1, No. 6.

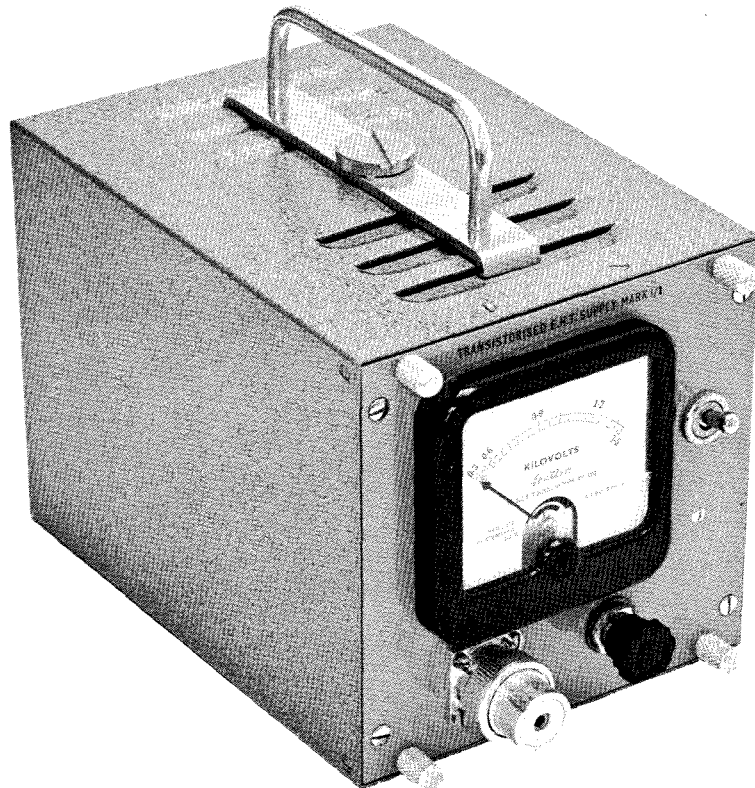
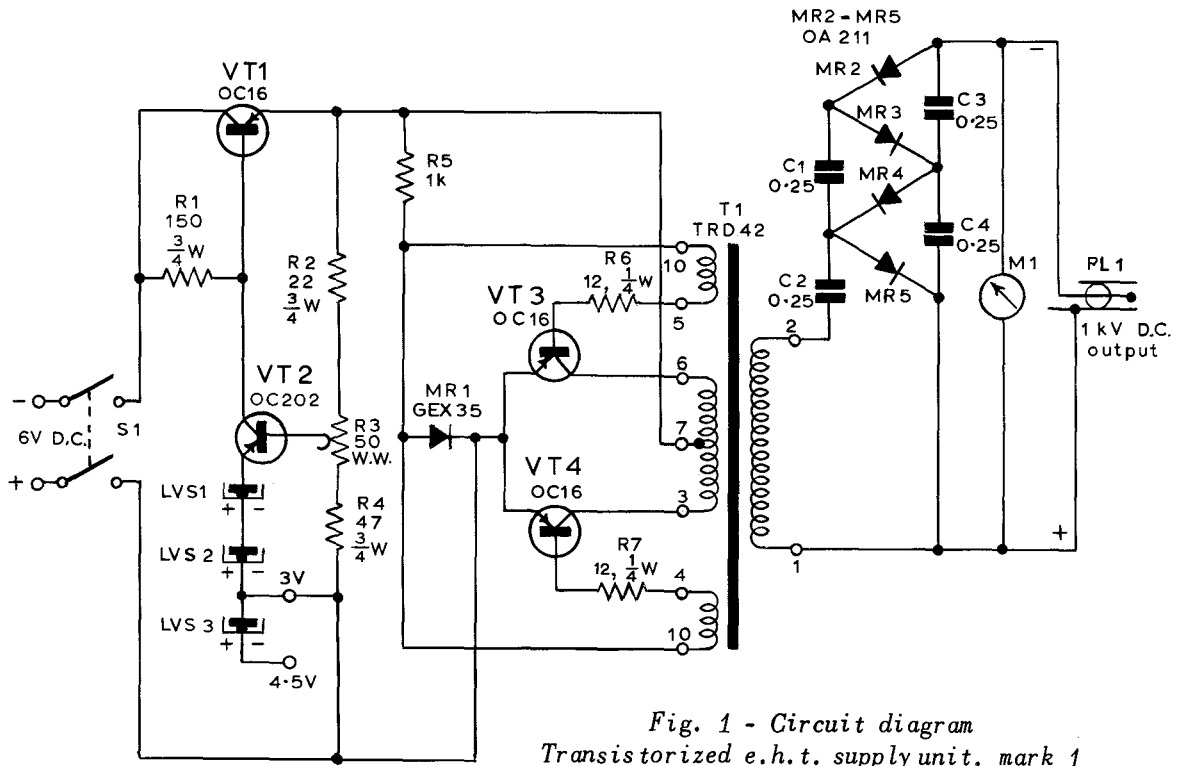
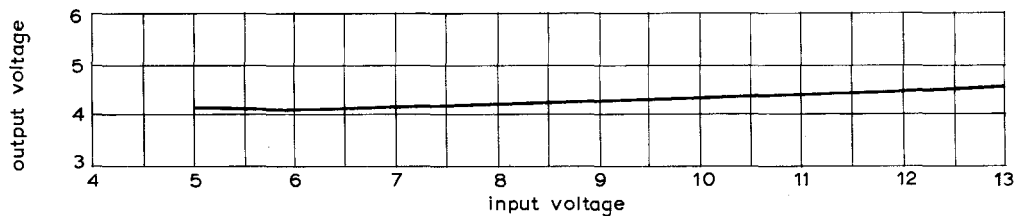
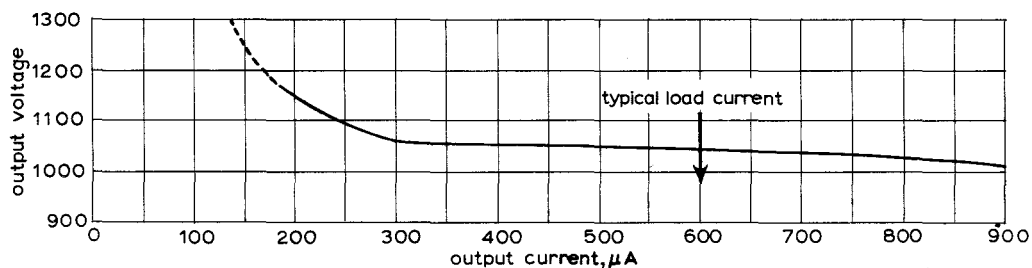


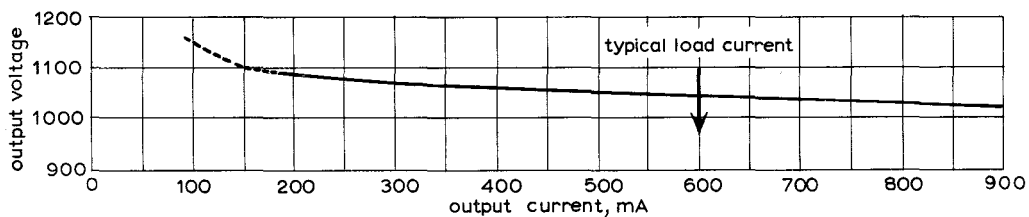
Fig. 2 - Stabilized e.h.t. supply unit



*Fig. 3 - Performance of voltage regulator only (set for 4.1V into converter)*



*Fig. 4 - Regulation of converter only*



*Fig. 5 - Regulation of complete power supply unit*